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We derive models of susceptibility of the crust. The crustal magnetization is modelled as a series of magnetic dipoles at the centres of triangles forming an almost regular tessellation of the Earth’s surface. The orientation of the dipoles is defined using a model of the core field calculated from satellite data. The susceptibility model is obtained by fitting the satellite data set with a main field subtracted. A regularization is introduced by minimizing a measure of the roughness in space of the susceptibility.

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Data Selection and Main Field Modelling

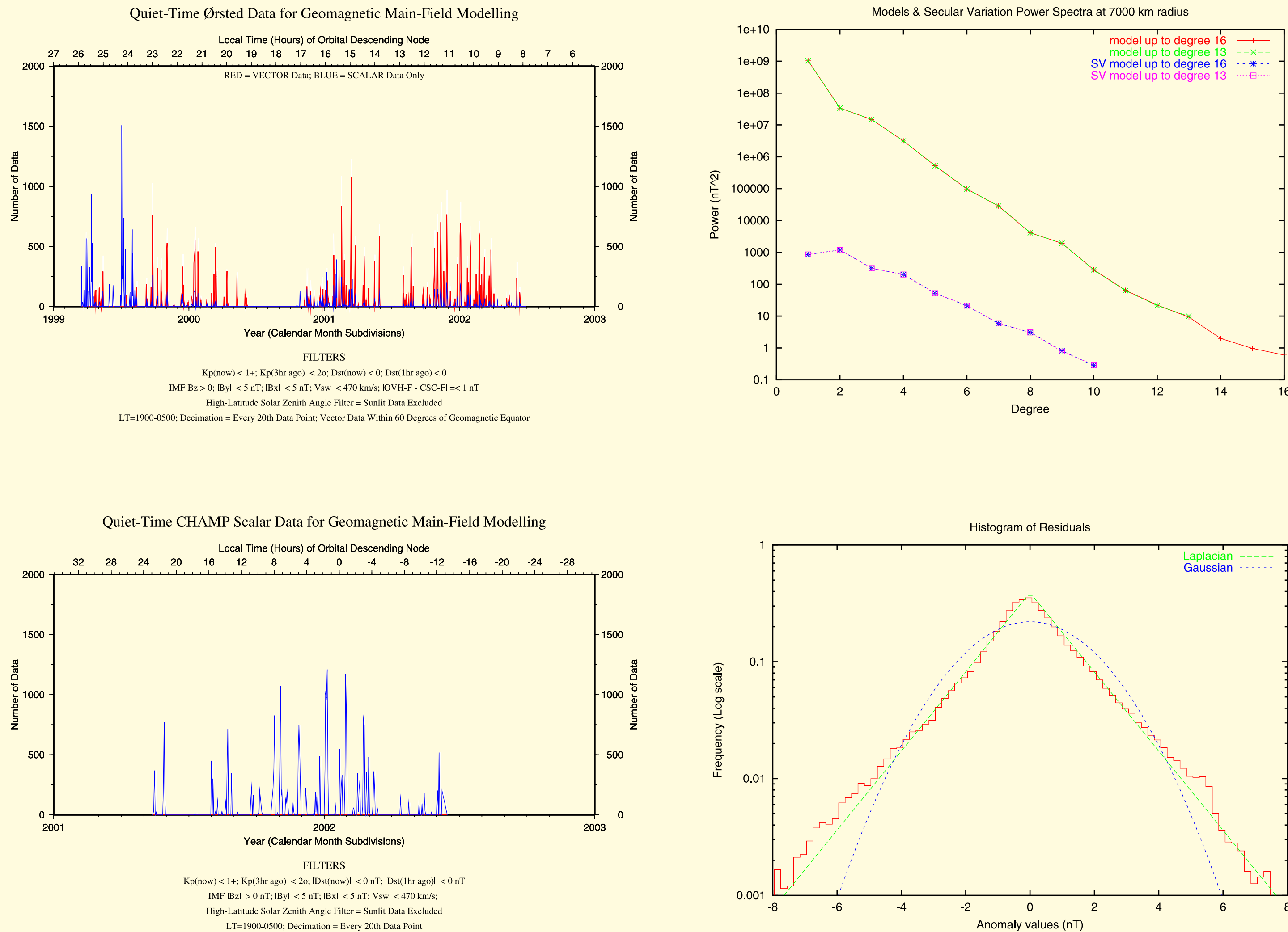
Data Filters

- Data downloaded 31 July 2002
- Scalar and vector Oersted data
- Scalar Champ data
- $Kp < 1+$, $-20 \text{ nT} < Dst < 0 \text{ nT}$
- 1900-0500 LT
- Sunlit Satellite Data Rejected
- Vector Data to 60° Geomagnetic Latitude
- $|ACE \text{ Interplanetary Field}| < 5 \text{ nT}$ in all components and $Bz > 0$
- ACE Solar Wind Speed $< 470 \text{ km/s}$.

Modelling Issues

Data fitted using reweighted least-squares algorithm and L1 (Laplacian) measure of the misfit. Model comprises spherical harmonics up to degree 13 or 16, linear secular variation up to degree 10, external field up to degree 2, *Dst* dependence of the external field with its associated induced internal field, annual and semi-annual dependence of the zonal coefficients of degree 1 and 2. Anisotropic error distribution is included for Oersted.

The Laplacian distribution fits well the distribution of residuals but large residuals are associated with the polar caps. Because of this uneven distribution of residuals the least robust parameters are the zonal Gauss coefficients.



Susceptibility Models & Anomaly Maps

The data is the same as in main field modelling with the main field model of maximum degree 16 or 13 and external field model subtracted. The output susceptibility models are called Model 16 and Model 13 respectively. The fit to the data is obtained using a reweighted least-squares algorithm and an L1 measure of the misfit.

The susceptibility models consist of 1280 evenly spaced dipoles on a sphere of radius 6372.1km. A regularization is introduced by minimizing the sum of the weighted absolute differences in integrated susceptibility between neighbouring discrete points. The total intensity anomaly maps are computed on a sphere of radius 7000km using the associated susceptibility model.

The two models are similar with a better definition of the susceptibility over India and Australia for Model 13 but a much higher level of noise in the south Atlantic. A small amount of noise is visible along the dip equator. More Champ data needs to be accumulated and the model needs to be refined before we are able to see oceanic ridges or other tectonic features. The susceptibility values are in the expected range with a maximum over the Bangui anomaly (0.03).

Both total intensity anomaly maps present the usual features: Bangui, Gulf of Mexico and North European anomalies. A lot of noise is present in the south Atlantic in the map associated with Model 13. Total intensity anomaly value ranges are -8.5 nT to 8.4 nT for Model 13 and -5nT to 5 nT for Model 16.

